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NOTES FROM PACIFIC COAST OBSERVATORIES

STARS WHOSE SPECTRA ARE COMPOSITE

In the progress of the work of the Henry Draper Memorial, Harvard Observatory had observed, up to 1913, that seventy-six stars¹ have composite spectra; that is, spectra containing in each case the principal characteristics of two distinct spectral types. Professor Pickering has interpreted the composite spectrum to mean that the stellar source is not the single star which it appears to be when viewed in a telescope, but that it consists of two stars so close together that they appear as a single star, and whose spectra are of quite different types. The resulting blended spectrum will show the leading features of both types more or less successfully, depending upon the relative brightness of the two components. The inference may safely be drawn that, in general, each such pair of stars is a binary system in which the two components revolve around their common center of mass. The spectrograph should detect variable radial velocities in these systems, if continued thru a sufficient period of time, and if the orbital motions are not in a plane at right angles to the observer's line of sight.

Of the 76 composites, 40 are brighter than visual magnitude 5.5, and 36 are fainter.

In the regular pursuit of the program of radial velocity determinations with the Mills spectrographs at Mount Hamilton and at Santiago, Chile, we have obtained several spectrograms of each of 37 of the brighter group of 40 composites, and one spectrogram of another star in the group; only two stars in the group of 40 remain unobserved. We have secured no spectrograms of the 36 composites fainter than 5.5 visual magnitude, and in fact we have no plans as to observing those stars.

The observations of the 37 stars have led to results which may be described as follows:

Twenty-three stars of the group have variable radial velocity.

For six stars the radial velocities seem to have varied thru small ranges, but the apparent variations may have resulted from the normal and unavoidable errors of observation. Future spectrograms will probably establish that some or all of the suspected variations are real.

¹To the lists of stars with composite spectra, as published in *Annals H. C. O.*, **28**, 92 and 229 and **56**, 113 and 160, and in *Harvard Observatory Circular*, No. **178**, are to be added five such stars mentioned in a letter received from Miss Cannon.

For eight stars the observed results have shown no appreciable variations.

If all of the thirty-seven stars are binary systems, as their composite spectra indicate, it is reasonable to expect that some of the periods of revolution are long, in which cases the spectrographic observations, made within short periods of time, would not be able to detect variations in their radial velocities. It is also to be expected that the orbital planes of some of the systems are nearly perpendicular to the observer's line of sight, and the spectrograph is powerless to detect motions within those systems. So far as our spectrographic observations are concerned, there is no reason to doubt that all of the thirty-seven stars are binary systems.

Four or five scores of the naked-eye stars have been found at various observatories to have two sets of lines in each of their recorded spectra, with the two sets essentially or nearly alike. The two sets of lines proceed from the two close components of binary systems, and the spectra are in fact composite, but in practice the term "composite" has been applied only to the combination of spectra of very different types.

W. W. CAMPBELL.

THE VARIABLE VELOCITY OF β CYGNI

The brighter component of the well-known double star β *Cygni* ($\alpha = 19^h 27^m$; $\delta = +27^\circ 45'$) has been observed for radial velocity with the Mills spectrograph on twenty-five nights between 1898 and 1918 inclusive. There were indications in 1910-11 that the velocity varies slowly. The observations secured in 1917-18 converted the indications into certainty. The observed radial velocities are as grouped below, the subscripts indicating the number of individual results upon which the group velocities depend.

1898-01,	$V_5 = -25.3$ km./sec.
1904-07,	$V_2 = -24.4$
1910-12,	$V_6 = -23.2$
1913-14,	$V_6 = -23.0$
1917-18,	$V_6 = -21.6$

The fainter component in the visual binary system is $35''$ from the brighter component, in position angle 55° , and no appreciable change in the relative positions of the two components has been observed in the century or more covered by position observations.